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BUSTAMITE FROM FRANKLIN FURNACE, NEW JERSEY[1]

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AND

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Recently a lot of some ten specimens of a material of unusual character from Franklin Furnace, N. J., was submitted to the National Museum for study by Ward's Natural Science Establishment of Rochester. This material contains several rare or new minerals but owing to their intimate intermixture it is being found exceedingly difficult to secure pure materials for analysis. The present paper is the first of several which will, in all probability be published on the basis of this material as the study of the minerals progresses.

The main bulk of the specimens consists of a pure white feldspar-like mineral which is probably albite although, owing to certain anomalous characters, it is but tentatively identified pending analysis. Scattered through this albite are resinous masses of brown garnet, coppery scales of biotite, and prismatic grains of the bustamite described below. In certain areas the feldspar is largely replaced by a fine granular aggregate which varies from white to bright blue in color and consists, as shown by optical study, of an intergrowth of several minerals at least one of which is an undescribed silicate containing lead. The bluest of this material was labeled cyprine but such preliminary examinations as have been made indicate that the blue and the white materials are identical.

The bustamite, which is moderately abundant in the specimens, is delicate pale pink in color but fades somewhat on exposure to light. It forms prismatic grains and masses reaching 1.5 cm.

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[1] Published by permission of the Director of the U. S. Geological Survey and the Secretary of the Smithsonian Institution.

in maximum length although the average is very much less than this. Occasionally it contains included or intergrown garnet, biotite, and "cyprine." The luster is beautifully silky, like that of many specimens of wollastonite, which the mineral greatly resembles, and, owing to the perfection of the cleavages the mineral has a fibrous appearance.

Before the blowpipe the bustamite fuses at a moderately high temperature to a black glass. It is only partly decomposed by boiling with acids. A sample of material estimated by microscopic examination to be 99% pure was analyzed yielding the following results and ratios:

Analysis and Ratios of Bustamite

Constituent	Per cent	Ratios		
SiO_2	48.44	.8038	80.38	1.00×1
FeO	.27	.0017		
CaO	25.20	.4493		
MnO	25.20	.3553	82.89	1.03×1
MgO	.65	.0161		
ZnO	.53	.0065		
Ignition	.34			
Total	100.63			

These ratios indicate that the mineral is essentially an anhydrous metasilicate of manganese and lime, these oxides, coincidentally, being in exactly equal percentages, although, owing to its lower atomic weight, lime is, molecularly, somewhat in excess of manganese, the ratio $CaSiO_3$:$MnSiO_3$ being approximately 4:3. On chemical grounds this may be regarded either as a calcium rhodonite or a manganese wollastonite. The mineral does not form euhedral crystals but the cleavages are sufficiently perfect that the cleavage fragments yield good signals and concordant measurements on the goniometer. There are cleavages in four directions in one zone corresponding to the planes *b*(010), *m*(110), $M(1\bar{1}0)$, and *a*(100) of rhodonite. In the following table are given the measurements obtained on four cleavage fragments. The average angles are compared with the theoretical angles for the same faces for rhodonite and with the angles given for pyroxmangite by Ford.[2] The best cleavage is that taken as *b*(010) to bring the angles into the closest possible agreement with rhodonite. The luster on this cleavage is decidedly pearly. The cleavages *m*(110) and M($1\bar{1}0$) are only slightly less perfect and also have pearly luster on the cleavage surfaces. The least perfect cleavage is that taken as *a*(100) which has vitreous luster.

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[2] Ford, Wm. E., *Am. Jour. Sci.*, 36, 169, 1913.

CLEAVAGE MEASUREMENTS ON BUSTAMITE FROM FRANKLIN

	rho = 90°	phi =		
	b(010)	*m*(110)	M($1\bar{1}0$)	*a*(100)
Cleavage 1.	0°05′	93°53′	45°06′	139°43′
	0 05	95 12	45 00	139 59
Cleavage 2.	0 00	94 51	44 45	139 45
	....	94 53	.....	140 21
Cleavage 3.	0 30	93 52	44 50	140 17
	0 31	94 41	44 56	139 14
Cleavage 4.	1 17	93 53	45 06	139 43
	0 00	95 12	45 00	139 59
Average	0 00	94 33	44 58	139 53
Rhodonite	0 00	94 26	45 53	138 21½
Pyroxmangite	0 00	.....	45 14	137 14

Rhodonite is described as having cleavages parallel to *m*(110) and M($1\bar{1}0$), with a less perfect cleavage parallel to *c*(001). No cleavages parallel to the pinacoids *b*(010) and *a*(100) have been reported. Several cleavage fragments from fowlerite crystals from Franklin were examined and found to show only the three cleavages reported for thodonite, no trace of the additional cleavages found in the bustamite being seen. The basal (001) cleavage was marked in the fowlerite while no trace of it could be found in the bustamite. A sample of bustamite from Schio-Vicentin, Italy, was not satisfactory for goniometric measurement of the cleavages as it was composed of slightly divergent prismatic fibers deformed by mutual interference and too small to yield good cleavage fragments. No trace of the basal cleavage could be detected in this or in fragments of pyroxmangite.

Although, as shown below, the bustamite is triclinic and not referable to wollastonite, which is monoclinic, very interesting results are obtained upon comparing the angles of the two. Thus when the bustamite is oriented so as to make the most perfect cleavage *c*(001), the least perfect cleavage remaining *a*(100), the other two perfect cleavages fall at the positions of *v*(101) and *t*($\bar{1}01$). Wollastonite is described as having cleavages parallel to *a*(100), *c*(001), and $t(\bar{1}01)$. No cleavage parallel to *v*(101) has been reported but measurement of a cleavage fragment of wollastonite from Natural Bridge, N. Y. (Cat. 48314), showed that cleavages *v*(101) and $t(\bar{1}01)$ were both equally developed. The angles are compared below:

Comparison of Angles of Bustamite and Wollastonite

	phi = 90°	rho =	
	Bustamite cleavage measured	Wollastonite theory	Wollastonite cleavage measured
c(001)	5°09′	5°30′	4°49′
a(100)	90 00	90 00	90 00
v(101)	45 09	45 33	44 40
$t(\bar{1}01)$	39 49	39 35	40 18

Optical Properties: The mineral powders into fibers resembling those of wollastonite, and the microscope and goniometer show that there are several cleavages. Fragments lying on the best cleavage (110) show another cleavage, nearly as good, at about 90°, give extinction (Z) at about 12° to the trace of the second cleavage, and show the emergence of the acute bisectrix out of the field of the microscope across the length. Such fragments turned on the other cleavage at about 90° $(1\bar{1}0)$, which is nearly as perfect as the first, give positive elongation and nearly parallel extinction and also show the emergence of the acute bisectrix out of the field across the length. Sections lying on a third less perfect cleavage (010) that bevels the edges of the other two show the emergence of the acute bisectrix just out of center and give no sharp extinction in white light, with extinction for yellow light (Z) to length 36°. Fragments lying on a fourth imperfect cleavage (100) in the same zone give nearly parallel extinction and positive elongation and show the emergence of Y near the center of the field.

The mineral is optically−, $2V = 44° \pm 3°$, dispersion $\rho < \nu$ slight, crossed dispersion considerable.

$\alpha = 1.662$; $\beta = 1.674$; $\gamma = 1.676$; all ± 0.003.

Bustamite from Schio-Vicentin, Italy, kindly furnished the authors by Colonel Roebling, is in coarse fibers or columns associated with calcite. The fibers show two perfect but unequally developed cleavages parallel to the length of the fibers. Fragments lying on the most perfect cleavage give nearly parallel extinction, and most fragments show the emergence of an optic axis near the center of the field of the microscope. The plane of the optic axes is parallel to the length, and the acute bisectrix is just out of the field of the microscope. The axial angle is moderate. A few sections show inclined extinction and a small optic angle with the acute bisectrix just out of the field. Turned on the other cleavage, which is at about 90°, the fibers show strong birefringence, and X to the length is 39°. These sections commonly show polysynthetic twinning with symmetrical extinction and the composition plane about normal to the fragments and parallel to the elongation, probably in the plane of the more perfect cleavage. This mineral is optically+, 2V is variable and in most pieces is medium to medium large, $\rho<\nu$ is perceptible. The indices of refraction vary about 0.01, and the average values are:

$$\alpha=1.721 \qquad \beta=1.725 \qquad \gamma=1.736$$

These properties indicate only a moderate content of lime.

The properties of bustamite from Franklin Furnace are very different from those of fowlerite from Franklin Furnace, of rhodonite from Broken Hill[3] and of rhodonite, labelled bustamite, from Schio-Vicentin, Italy, as shown in the accompanying table.

OPTICAL PROPERTIES OF BUSTAMITE, RHODONITE, AND FOWLERITE

	Bustamite Franklin Furnace	Rhodonite Schio-Vicentin, Italy	Rhodonite Broken Hill N. S. W.	Fowlerite Franklin Furnace
α	1.662	1.721	1.733	1.726
β	1.674	1.725	1.740	1.730
γ	1.676	1.736	1.744	1.737
$\gamma-\alpha$	.014	.015	.011	.011
Opt. char.	—	+	—	+
2V	44°	med. large	medium	large
Dispersion	$\rho<\nu$ slight Crossed strong	$\rho<\nu$ perc.	$\rho<\nu$ weak	
Optical orientation	Z $\wedge$ zone of cleavage 36°. X nearly ⊥ imperfect cleavage	Y nearly ⊥ to second cleavage X $\wedge$ elong. about 39°.		

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[3] Larsen, E. S., The Microscopic Determination of the Non-opaque Minerals, *U. S. Geol. Survey Bull.* 679, 126-7, 1921.

A large cleavage piece of pale pink bustamite from Franklin Furnace kindly presented to the U. S. National Museum by Mr. R. B. Gage of Trenton, N. J., has the following optical properties: Optically−, 2V medium. $\alpha=1.667$, $\beta=1.678$, $\gamma=1.680$.

Fragments lying on the most perfect cleavage show the emergence of X out of the field and give variable but small extinction angles. Several specimens from Franklin Furnace that superficially resembled the bustamite were examined microscopically and proved to have optical properties much like those of the fowlerite variety of rhodonite, though with somewhat lower indices of refraction.

Conclusion: The bustamite from Franklin Furnace is a triclinic pyroxene, related to rhodonite. Chemically it contains nearly equal molecular proportions of CaO and MnO with CaO in slight excess. In optical properties it differs considerably from rhodonite. Out of ten specimens of bustamite and rhodonite, mostly from Franklin Furnace, that have been examined optically, two had properties very near those of the analyzed bustamite, six had properties near those of fowlerite, a variety of rhodonite, while one had properties about midway between the rhodonite and bustamite. It, therefore, seems probable that bustamite is a subspecies of rhodonite with the approximate composition $CaO.MnO.2SiO_2$. Further work to finally determine this is desirable, and the authors would like to obtain samples of calciferous rhodonite and bustamite for optical study to determine to what extent replacement of MnO by CaO takes place in rhodonite.

ALTERATION OF SILICATES BY SONSTADT'S SOLUTION

T. L. Walker, *University of Toronto*

In the preparation of samples for analyses while engaged in an investigation of the zeolites of Nova Scotia, the writer learned that Sonstadt's mercuric potassic iodide solution may not be used either for separations or for specific gravity determinations in the case of some of the zeolites, owing to the readiness with which the minerals are changed by the substitution of potash for soda and lime, accompanied by a large loss of water and an increase in density.

The classic experiments of Lemberg[1] showed that alterations of this type are common when zeolites rich in lime or soda are treated with strong solutions of potash but most of his experiments were carried out in sealed tubes at high temperatures and extended over long periods of time—usually several months. The writer's observations show that in the case of gmelinite and okenite the substitutions are almost instantaneous and that for the former it is almost complete in the short time usually employed in specific gravity determinations.

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[1] Lemberg, *Zeit. deutsch. geol. Gesell.*, 28, 546.

In the case of gmelinite from Pinnacle Island, Nova Scotia, it was noted during the separation that there was a marked tendency for a portion floating on the surface to gradually sink so that sharp determinations and separations were not possible. The analysis of the gmelinite separated by Sonstadt's solution is shown in column I. As substitution of potash was suspected, a sample from Long Island, another of the Five Island group, was separated by methylene iodide and analysed, column II. A part of this same sample was placed in Sonstadt's solution for about twenty minutes and analysed with the result shown in column III. (Analyses by E. W. Todd.)

	I	II	III	IV	V
SiO_2	51.66	50.24	49.02	56.02	55.08
Al_2O_3	17.88	17.93	18.42	0.26	0.26
Fe_2O_3	.....	0.37	0.34	0.12	0.20
CaO	1.42	.41	.30	26.46	26.57
MgO	.....	.....	.....	0.24	0.12
Na_2O	1.54	10.08	1.20	0.28	0.76
K_2O	11.16	.69	14.86	2.24	0.60
H_2O	15.86	20.38	16.27	13.25	16.13
CO_2	.....	.....	.....	1.58	0.32
	99.52	100.10	100.41	100.45	100.04
Sp. gr.	2.135	2.045	2.090	2.388	2.333

The gmelinite which had been treated with Sonstadt's solution was no longer vitreous in luster. It was dull and earthy in appearance and crumbled readily to a fine powder. Similar results were obtained in the case of okenite from Morden, N. S. Column IV is an analysis of a sample treated with Sonstadt's solution, and column V represents the composition of a second sample prepared from the same specimen by using bromoform and carbon tetrachloride. (Analyses by E. W. Todd.)

The limitations indicated in the use of Sonstadt's solution have doubtless been observed by others but in the writer's opinion it is desirable to keep these results in mind in the selection of a suitable heavy solution for separations of hydrous silicates readily decomposed by acids. Possibly other analyses of zeolites exhibit irregularities due to similar substitutions.

DELAFOSSITE FROM KIMBERLY, NEVADA

Austin F. Rogers, *Stanford University*

Of the numerous copper minerals, one of the rarest and most interesting is delafossite, a cuprous metaferrite, with the formula, $CuFeO_2$ or $Cu_2O.Fe_2O_3$. Delafossite was first described from the region of Ekaterinburg, Siberia, by Friedel in 1873.[1] No further mention of the mineral was made until 1913, when the writer[2] called attention to its occurrence at Bisbee, Arizona, and was able to establish it as a valid mineral species.

The object of this note is to place on record the discovery of delafossite at a second American locality. A specimen of the mineral in question was sent to my colleague, Professor W. F. Dietrich, by Mr. M. L. Crandall, Chief Engineer of the Consolidated Coppermines Company. The specimen was found on the 1200 ft. level of the Alpha mine (formerly called the Giroux) at Kimberly, Nevada. According to Mr. Crandall, "It was found in a body of clay containing some oxidized copper ore, occurring in oxidized jasperoid, near its contact with limestone."

Description of the Delafossite: The Kimberly delafossite is a black metallic mineral and occurs in spherical aggregates from 1 to 3 mm. in diameter which are disseminated through a white to pale gray clay. (The clay is probably halloysite, the amorphous equivalent of crystalline kaolinite, as it is optically isotropic and has an index of refraction of $1.543 \pm .003$.) The spherulitic aggregates have a fairly well defined radial structure and hence may be called spherulites. Spherulites of minerals with metallic luster seem to be very rare. The individual crystals of the spherulites have an imperfect cleavage parallel to their length. On the exterior of the spherulites the delafossite shows imperfectly developed crystals of triangular outline, which recalls the fact that delafossite is hexagonal in crystallization. The mineral has a hardness of about 5½ and is very slightly magnetic. It has a black streak.

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[1] *Compt. Rend.*, 77, 211.

[2] *Amer. Jour. Sci.*, [4] 35, 290.

In general appearance the specimen suggests a manganese mineral such as manganite, but chemical tests prove its identity with delafossite.

Chemical Tests for Delafossite: The delafossite is readily soluble in hydrochloric acid and aqua regia, but is only slightly soluble in nitric acid. Ammonium hydroxide added to an aqua regia solution of the mineral gives a red-brown precipitate of ferric hydroxide and a blue coloration to the filtrate. The hydrochloric acid solution gives tests for ferrous and ferric iron with solutions of potassium ferrocyanide and ferricyanide respectively. The ferrous iron test indicates that a change in the valence of some of the iron has taken place during solution, for in the original mineral all the iron is in the ferric condition.

Stokes[3] has established the reversibility of the following reaction between cuprous, cupric, ferrous, and ferric ions: $Cu'' + Fe'' \rightleftarrows Cu' + Fe'''$.

Chemical Formula of Delafossite: The chemical formula of delafossite, $Cu_2O.Fe_2O_3$, given by Friedel for the original Siberian mineral was confirmed by an analysis of the Bisbee mineral made under the writer's direction by Mr. G. S. Bohart. The formula may be written in the form, $CuFeO_2$, which is interpreted as cuprous metaferrite, a salt of the hypothetical acid, $HFeO_2$, which is derived from ferrous acid (H_3FeO_3) thus: $H_3FeO_3 - H_2O = HFeO_2$.

With the exception of minerals of the magnetite group (magnetite, franklinite, magnesioferrite, and jacobsite), delafossite is the only known metaferrite.

Validity of Delafossite as a Mineral Species: Delafossite has not been recognized as a distinct species in the mineralogical treatises; in both Dana's *System* and Hintze's *Handbuch* it is included in the Appendix to Oxides. The occurrence of a well-crystallized mineral from Bisbee, Arizona, which gave on analysis percentages for iron and copper almost identical with the theoretical for $CuFeO_2$, established delafossite as a definite mineral. It is interesting to find delafossite at a third locality.

Characteristic Occurrence of Delafossite: Its occurrence at Kimberly, Nevada, is similar to that at Bisbee, Arizona. In both localities it occurs in the lower part of the oxidized zone. It probably occurs in other copper mines and has been overlooked.

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[3] *U. S. Geol. Surv. Bull.* **186**, 44, 1906.

A NEW TYPE OF MONOCHROMATIC LIGHT SOURCE[1]

ALBERT B. PECK, *University of Michigan*

All scientific workers who have had occasion to make use of monochromatic light sources have doubtless had the experience that one type of source gives suitable results in some cases and not in others. The writer believes, however, that the device here described possesses sufficient merit in point of compactness, ease of manipulation, and in the results obtained, to warrant attention being called to it as an aid to others engaged in the type of work for which it is adapted and as a possible aid in other lines.

This monochromatic light source is simply an adaptation of the Monroe platinum filtering crucible, one in which the filtering agent is platinum sponge. Platinum sponge will absorb considerable quantities of salt and it will be found that the flame from this source is sufficiently intense for practically all ordinary laboratory work where monochromatic light is desired, such as for refractive index determinations by prism methods, the Abbe refractometer, and immersion methods with the microscope. It, furthermore, gives a pure flame of any desired salt containing very little contamination of sodium; if this does occur it may be eliminated by boiling in acid, washing in distilled water and re-impregnating. It also has the advantage of neatness and compactness, necessitating but one flame to furnish both the heat and the color. In a "life test" one of the cylinders containing a lithium salt, which is rather volatile, was burned at intervals which totalled approximately 24 hours and at the end of the period was apparently as intense as at the start. It is obvious, therefore, that only occasional renewal of the salt is necessary.

The starting point in making the monochromator is a thin piece of sheet platinum one half to three fourths of an inch square. This is riddled with small holes by a needle point, as closely placed as possible and yet have the sheet retain a reasonable amount of strength.

The next step is to precipitate $(NH_4)_2PtCl_6$ from a solution of H_2PtCl_6 by the addition of NH_4OH and NH_4Cl. This precipitate is filtered onto a filter paper and the resulting paste is worked into the pin-holes in the platinum sheet by rubbing the paste around on the sheet with the rounded end of a glass rod or other suitable means. Too much paste should not be put on at first in order that there may not be a large loss of material.

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[1] Paper presented at the annual meeting of the Mineralogical Society of America, Amherst, Mass., December 29, 1921.

The platinum sheet, impregnated with paste, should then be slowly dried over an open flame, care being taken that the drying does not take place fast enough to cause sudden steam expansion and consequent forcing of the paste out of the holes. When the drying has been sufficient to expel the liquid occluded in the paste, the sheet may be inserted into a hot flame and given a thorough ignition. The result of this is to drive off the volatile NH_3 and Cl constituents of the paste, leaving behind in the holes a brown or black mass of platinum sponge. More paste is then worked into the holes and again heated and ignited. Usually two or three such treatments are necessary to completely fill the holes with sponge. If a microscope is handy, the process can be followed and it can readily be seen when the holes are completely filled.

The next step is to attach a stiff wire to the sheet. For this purpose a piece of platinum or copper wire approximately one sixteenth inch in diameter is satisfactory. It may be attached either by welding the two or by running the wire through a hole near the edge of the sheet and making it tight by twisting.

After the wire is attached the sheet is rolled into a cylinder or helix of about one eighth to one quarter inch outside diameter. This should be done carefully to avoid dislodging any of the platinum sponge from the pin-holes.

The sponge is then ready to be impregnated with some salt to give the desired flame color. The cylinder should be immersed in a moderately concentrated solution of $NaNO_3$ or NaCl, for example, and then slowly dried over an open flame observing the same precautions as in drying the $(NH_4)_2PtCl_6$ paste. When dry it may be strongly ignited and as it becomes hotter, the flame color becomes more intense. This should be repeated two or three times in order that the platinum sponge may have a chance to absorb as much salt as possible. For red flames, $LiNO_3$ or LiCl should be used.

For holding the cylinder in the flame a simple device as shown in the illustration (Fig. 1) was constructed. It consists essentially of a brass collar which may be slipped over a Bunsen or Meeker burner and is held in place by a small set-screw. On the opposite side a small hole was bored vertically through the collar, large enough to take the wire attached to the cylinder. The wire also

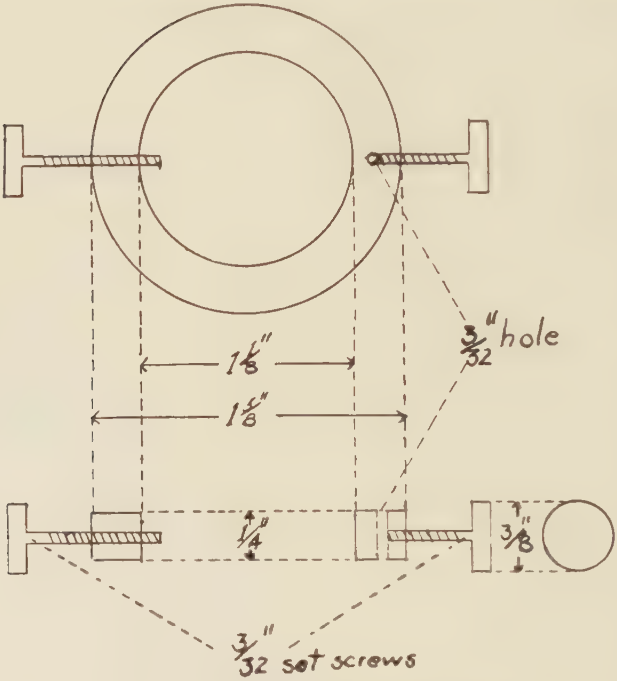

FIG. 1. Collar mount for Meeker burner

may be held at any point by another set-screw and thus the cylinder, bent at any desired angle into the flame, may be raised and lowered. For a Bunsen burner a collar of about five eighths inch internal diameter is generally large enough. For the ordinary Meeker burner one of one and one eighth inches diameter is sufficient. The latter burner is more satisfactory since it gives a hotter, broader and steadier flame, less influenced by air currents.

The writer wishes to record here that the idea of adapting the principle of the Monroe crucible to a monochromatic light source is not his exclusively but rather that of Dr. Edward Schramm, research chemist for the Onondaga Pottery Company, at whose suggestion and by whom it was developed during the summer of 1921. The collar for attaching it to the burner is of later development.

PROCEEDINGS OF SOCIETIES

NEW YORK MINERALOGICAL CLUB

Regular Monthly Meeting of March 15, 1922

The regular monthly meeting of the New York Mineralogical Club was held in the American Museum of Natural History on the evening of March 15, at 8:15 P.M. The President, Dr. George F. Kunz, presided and there was an attendance of 24 members.

The following names were referred to the Committee on Membership: Mr. E. Victor Collins of 125 E. 28th Street and Mr. Herbert B. Thowless of Newark, N. J. Mr. Whitlock reported that Mr. Samuel G. Gordon would address the Club on April 12th, his subject to be "*Mineral Collecting in the Andes.*"

The President then introduced the speaker of the evening, Prof. James F. Kemp, of Columbia University, who delivered an interesting and very useful paper on "*The Association of Minerals and Rocks.*" In his opening remarks Prof. Kemp spoke of the new methods of mineralogical research and the connection of geology with mineralogy. He took up in detail the various types of rock formation which constitute the association of mineral specimens from a collector's point of view and discussed the mineral species occurring under each association. In this discussion the speaker used the following syllabus:

IGNEOUS ROCKS OF GRANITOID TEXTURE; Microlitic cavities (orthoclase, quartz).

BASIC ROCKS, OLIVINE TYPE ETC.; (Native metals, iron precipitate).

PORPHYRITIC ROCKS; (Feldspars weathered out, augites, rarely dihexagonal quartz).

BORDER "ZWITTER," GREISEN; (Topaz, cassiterite, fluorite, apatite).

PEGMATITE, GIANT CRYSTALS; (Biotite, muscovite, beryl, tourmaline, etc).

AFTER EFFECTS OF INTRUSIVE ROCKS.

AFTER EFFECTS OF BASALTIC ROCKS; (Zeolites and related minerals).

CONTACT ZONES, ALUMINOUS WALLS OF THE INTRUSIVE; (Chiastolite, sillimanite, staurolite, spinel, corundum).

CONTACT ZONES IN LIMESTONE; (Lime silicates, wollastonite, diopside, vesuvianite, the scapolites, epidote etc.).

REGIONAL METAMORPHISM; Mica schists (garnet, cyanite).

ORE MINERALS; Physical conditions surrounding formation of minerals in veins. (Depth of pressure; Deep vein minerals; Zone of secondary enrichment.)

The President called attention to the next meeting as an Annual Meeting for election of officers and appointed as a Nominating Committee: Mr. Ashby (Chairman), Mr. Wintringham and Capt. Miller. Mr. Wintringham exhibited a rutile twin of unusual habit. Mr. Broadwell invited the Club to the meeting of the Newark Mineralogical Club on Sunday afternoon April 2.

At the close of the meeting a vote of thanks was tendered to Prof. Kemp for his highly valuable paper.

HERBERT P. WHITLOCK, *Recording Secretary.*

PHILADELPHIA MINERALOGICAL SOCIETY

Academy of Natural Sciences, April 14, 1922

A stated meeting of the Philadelphia Mineralogical Society was held on the above date with the president, Mr. Trudell, in the chair. Nineteen members and three visitors were present. Messrs. Louis Bregy, and William Skinner were proposed for active membership.

Mr. Harry W. Trudell gave an interesting address on "*Some mineral localities of North Carolina and Virginia*" in which a trip to these states was described, illustrated with colored slides and specimens.

Mr. Samuel G. Gordon read a paper on "*Preliminary Notes on Vauxite and Paravauxite, two new minerals from Llallagua, Bolivia.*" Their characters follow:

VAUXITE, $4FeO.2Al_2O_3.3P_2O_5.24H_2O+3H_2O$. Triclinic.

Color: Sky-blue to venetian-blue; streak, white; luster, vitreous; transparent. Form: Aggregates of small tabular crystals. $H=3.5$; specific gravity $=2.45$. Optically $+$, $\alpha=1.551$, $\beta=1.555$, $\gamma=1.562$, all $\pm .003$; $2V=32°$; Bx_a emerges on sections parallel to b (010). Dispersion considerable, $\rho>\nu$. Strongly pleochroic, colorless to blue. Name: In honor of Mr. George Vaux, Jr., of Bryn Mawr, Penna.

PARAVAUXITE, $FeO.Al_2O_3.P_2O_5.6H_2O+5H_2O$. Triclinic.

Colorless; streak, white; luster, vitreous to pearly; transparent. Form: Small prismatic crystals. $H=3$; sp. gr. $=2.30$. Perfect cleavage parallel to b (010). Optically $+$; $\alpha=1.554$, $\beta=1.558$, $\gamma=1.573$; all $\pm .003$; Sections parallel to b (010) show emergence of an optic axis. Like vauxite, occurs on wavellite at the tin mines of Llallagua, Bolivia.

Fine specimens of andorite and zinkenite from Oruro, Bolivia, were exhibited.

Mr. Knabe reported on a trip to the Poorhouse quarry, exhibiting chesterlite. Mr. Hoadley reported on a trip to the Harlem ship canal. Mr. Frankenfield exhibited sillimanite from the vicinity of Moro Phillip's mine, Delaware County.

SAMUEL G. GORDON, *Secretary.*

NOTES AND NEWS

AN UNUSUAL ALTERATION PRODUCT FROM PARK CITY, UTAH—During the field season of 1920 the writer collected a number of ore specimens in the Daly-Judge Mine, Park City, Utah. These ores were polished and examined under the microscope at State College, Pa., and Dr. E. S. Moore has kindly permitted publication of the results of the investigation, which were incorporated in the writer's thesis.

The common lead, zinc and copper minerals with their accessories form the ore deposits of this district, galena being the principal ore mineral and it is found forming intergrowths with tetrahedrite.

An unusual series of alteration products was found in some galena specimens. The galena alters to a deep indigo-blue, massive product containing lead and copper sulfides. This alteration product begins to form along the fractures and cleavages of the galena and in some cases the alteration has proceeded until the galena has almost entirely changed to the blue product. This blue product on further alteration changes to anglesite which alters to cerussite. The blue mineral is found most frequently replacing the galena at the contact of galena with tetrahedrite in the intergrowths of the two minerals. It is thought that this mineral is either alisonite or cuproplumbite. According to Dana, it is not known whether these minerals represent definite homogeneous compounds or whether they are ill-defined alteration products. They may be represented by approximate formulæ as 3 $Cu_2S.PbS$ to

$Cu_2S.2PbS$. The chemical processes resulting in the formation of these products may be inferred as follows: Copper solutions derived from the breaking down of tetrahedrite permeate the galena along the cleavages and the lead sulfide is partially replaced by copper sulfide. After oxidation the copper sulfate is taken away in solution, since it is much more soluble than the lead sulfate.

W. H. Newhouse.

Attention is called to the XIIIth Session of the International Geological Congress to be held in Brussels, Belgium, August 10-19, 1922. Excursions will be conducted before the opening of the Session, also during and at the close of the Session. Fellows or members of the Mineralogical Society of America who expect to attend this Congress are requested to send their names to Secretary Whitlock so that the selection of official representatives of the Society can be made by the Council.

On May 1st the American Museum of Natural History announced the opening of the Morgan Memorial Hall of Minerals and Gems. This collection was presented to the City of New York by George Fisher Baker in memory of his friend, John Pierpont Morgan. Many new display cases have been installed and the specimens have all been remounted on pale buff fiber-board. The gems have been mounted on glass supports designed by Curator Whitlock, who will describe them in this Journal in the near future.

A new major subdivision has been created in the United States Geological Survey by raising the division of Alaskan mineral resources to the status of a branch. The work will continue under the direction of Colonel A. H. Brooks, whose title is chief Alaskan geologist.

Dr. Maximilian Weber of the Munich Polytechnikum has been appointed Professor of petrography at the University of Munich, succeeding the late Professor Ernst Weinschenk.

ABSTRACTS—CRYSTALLOGRAPHY

THE INTERFERENCE COLORS OF QUARTZ IN POLARIZED LIGHT. T. Liebisch and A. Wenzel. *Sitzungsb. preuss. Akad. Wiss.*, **1917**, I, 3; thru *Neues Jahrb. Min. Geol.*, **1919**, Ref. 17-8.

This is an investigation of the intensity, tone and saturation of the interference colors, for various thicknesses, of quartz wedges. Edw. F. Holden.

THE RECOGNITION OF WEAK DOUBLE REFRACTION BY THE USE OF SENSITIVE TINTS. A. Wenzel. *Phys. Z.*, **18**, 472-9, 1917; thru *Neues Jahrb. Min. Geol.*, **1919**, Ref. 18-9.

The most sensitive tint with gypsum is the purple obtained with a plate of 0.056 mm. thickness. Somewhat less sensitive is the brighter purple obtained with a quartz plate, cut parallel to the optic axis, with a thickness of 0.0575 mm.

E. F. H.

THE FORMATION OF LARGE CRYSTALS IN RODS AND WIRES OF ZINC. W. Fraenkel. *Z. Elektrochem.*, **23**, 302-4, 1917; thru *Neues Jahrb. Min. Geol.*, **1919**, Ref. 122.

Zinc which has been mechanically worked recrystallizes with ease at high temperatures. E. F. H.

A COLORLESS FORM OF MERCURY IODIDE. G. Tammann. *Nachr. Ges. Wiss. Göttingen*, **1917**, 292–293; thru *Neues Jahrb. Min. Geol.*, **1919**, Ref. 131.

HgI, condensed at a pressure of 0.1 atm., or cooled to the temperature of liquid air, presents a colorless modification. E. F. H.

THE VISIBILITY ABOVE THE TEMPERATURE OF ISOTROPIC FUSION OF THE CONTACT BETWEEN ANISOTROPIC LIQUIDS AND CRYSTALS. F. Grandjean. *Compt. Rend.*, **164**, 431–4, 1917.

If an anisotropic liquid, resting on the surface of a solid crystal, be heated above the isotropic fusion point, and then cooled; the anisotropic condition will persist through a small temperature interval, due to the molecular forces at the surface of the crystal. E. F. H.

ORIENTATION OF THE SALTS OF CHOLESTEROL, AND THE ANISOTROPIC OLEATE LIQUIDS, ON CRYSTALS. F. Grandjean. *Compt. Rend.*, **164**, 636–9, 1917; thru *Neues Jahrb. Min. Geol.*, **1919**, Ref. 139.

The orientation of cholestryl caprinate, -benzoate, ammonium- and trimethylammonium oleates on halite, sphalerite, and talc was studied. The optically positive phase of cholestryl caprinate orients itself with its optic axis parallel to the diagonal of (100) on halite; to the longer diagonal of (011) on sphalerite; and on (001) on talc, there were six positions. E. F. H.

ORIENTATION OF ANISOTROPIC LIQUIDS ON THE CLEAVAGES OF CRYSTALS. F. Grandjean. *Compt. Rend.*, **164**, 105–7, 1917.

Anisotropic liquids placed upon the cleavage surfaces of solid crystals orient themselves in a manner that bears a simple relationship to the symmetry of the solid crystals. C. B. S.

THE VELOCITY OF CRYSTALLIZATION IN UNDER-COOLED PURE FUSIONS. R. Nacken. *Centr. Min. Geol.*, **1917**, 191–203.

The rate of growth of the crystal faces in salol increases as the temperature falls below its melting point (41.75°). E. F. H.

CRYSTALLIZATION OF SODIUM CHLORIDE ON MICA. Georg Kalb. *Centr. Min. Geol.*, **1917**, 145–146.

Salt crystallizes on mica in such a way that a trigonal axis of the cube is perpendicular to the basal plane of the mica, and a zone$(100) \wedge (111)$ of the salt is parallel to the zone $(001) \wedge (010)$ of the mica. E. F. H.

MERCURY IODIDE. III. A. Smits. *Z. phys. Chem.*, **92**, 345–350, 1917; thru *Neues Jahrb. Min. Geol.*, **1919**, Ref. 131-132.

A theoretical discussion of the relations between yellow and red HgI_2.

E. F. H.

ELECTRIC CONDUCTION IN ANISOTROPIC LIQUIDS. T. Svedberg. *Ann. Phys.*, **49**, 437–55, 1916; thru *Chem. Abst.*, **11**, 1078, 1917. SVEDBERG'S OBSERVATIONS CONCERNING ELECTRICAL CONDUCTIVITY IN ANISOTROPIC LIQUIDS. W. Voigt. *Ann. Phys.*, **52**, 222–8, 1916; thru *Chem. Abst.*, **11**, 1069, 1917.

The last paper is a mathematical discussion of Svedberg's conclusions, that the temperature coefficient of electrical conductivity of anisotropic liquids decreases abruptly at the temperature of isotropic fusion. C. B. S.

CRYSTALLINE LIQUIDS OBTAINED BY THE EVAPORATION OF A SOLUTION. P. Gaubert. *Compt. Rend.*, **163**, 392–4, 1916.

The formation of anisotropic liquids from solutions by evaporation produces spherulitic liquid crystals which differ from those produced by fusion of the solid.

C. B. S.

MINERALOGY

CRISTOBALITE. H. Le Chatelier. *Bull. soc. franc. min.*, **40**, 44–57, 1917.

THE INVERSIONS IN SILICA BRICKS. A. Scott. *Trans. Eng. Ceram. Soc.*, **17**, I, 137–52, 1917.

The two articles above relate to the artificial formation of tridymite and cristobalite. C. B. S.

PHOSPHORESCENT ZINC SULFIDE. E. Mac Dougall, A. W. Stewart, and R. Wright. *J. Chem. Soc.*, **111**, 663, 1917.

The maximum phosphorescence of ZnS occurs at the stage of incipient crystallization. C. B. S.

A PECULIAR TYPE OF CLAY. H. Reis, *Am. J. Sci.*, **44**, 316–18, 1917.

A peculiar clay composed of 98.5% minute crystals of dolomite is described.

C. B. S.

A METHOD FOR THE DETERMINATION OF THE DISSOCIATION PRESSURES OF SULFIDES, AND ITS APPLICATION TO COVELLITE AND PYRITE. E. T. Allen and R. H. Lombard. *Am. J. Sci.*, **43**, 175–195, 1917.

The origin of pyrite and covellite is discussed. C. B. S.

SOME MINERALS FROM DRUSES IN THE NEPHELINE-PHONOLITE FROM NESTOMITZ AT AUSSIG ON THE ELBE. J. E. Hibsch. *Tscher. Min. Petr. Mitt.*, **34**, 266–71, 1917; thru *Min. Abst.*, **1**, 155, 1921.

The minerals include fluorite, analcite, mesolite, thomsonite, calcite, and wad.

E. F. H.

COMPACT ZEOLITES. J. E. Hibsch. *Tscher. Min. Petr. Mitt.*, **34**, 262–5, 1917; thru *Min. Abst.*, **1**, 155, 1921.

Compact natrolite, analcite, and apophyllite from Bohemia, apparently end-products of the solidification of phonolitic magmas, are described.

E. F. H.

PRELIMINARY REPORT ON THE SYSTEM LIME-FERRIC OXIDE. R. B. Sosman and H. F. Merwin. *J. Wash. Acad. Sci.*, **6**, 532–7, 1916.

The optical properties of the compounds $CaO.Fe_2O_3$ and $2CaO.Fe_2O_3$ are given.

E. F. H.

NEWER MINERAL SYNTHESES. P. Niggli. *Forts. Min. Krist. Petr.*, **5**, 131–72, 1916; **6**, 35–66, 1920; thru *Min. Abst.*, **1**, 235, 1921.

A summary of the literature is given; and the paragenesis of minerals at high temperatures with the constitution of magmatic solutions, is discussed.

E. F. H.

MIXED CRYSTALS (Mg,Zn)$SO_4.7H_2O$. C. VIOLA. *Atti. Accad. Lincei,* (5) **25,** 285–99, 1916; thru *Chem. Abst.,* **11,** 1344, 1917.

Mixed crystals of $MgSO_4$ and $ZnSO_4$ are composed of alternate layers of each salt and therefore are not solid solutions but only physical mixtures. C. B. S.

WATERGLASS AND ALKALI SILICATES. W. PUKALL. *Ber. d. Chem. Ges.,* **49,** 397–436, 1916; thru *Neues Jahrb. Min. Geol.,* **1918,** Ref. 252.

Several crystalline hydrated silicates of K and Na were produced synthetically. E. F. H.

ARTIFICIAL TWINNING IN MAGNETITE. ANNI GRÜHN. *Neues Jahrb. Mineral. Geol.* **1918,** 99–112.

Pressure produced gliding parallel to (111) in magnetite; the path of the atoms during the gliding is given. E. F. H.

SEVERAL NEW MIXED CRYSTALS AND COMPOUNDS OF NICKEL OXIDE WITH OXIDES OF OTHER METALS. J. A. HEDVALL. *Z. anorg. allg. Chem.* **103,** 249–52, 1918; thru *Neues Jahrb. Min. Geol.* **1919,** Ref. 270.

Mixed crystals of the oxides of Mg, Zn, Mn, Al, and Sn with NiO were obtained by heating mixtures of the oxides at 900° C. with an excess of KCl. E. F. H.

NON-METALLIC INCLUSIONS; THEIR CONSTITUTION AND OCCURRENCE IN STEEL. A. MCCANCE. *J. Iron & Steel Inst.* **47,** 239–86, 1918.

By fusing $FeCO_3$ and SiO_2 small crystals were obtained which were identified by metallographic methods as grünerite. C. B. SLAWSON.

THE EFFECT OF CERTAIN IMPURITIES IN CAUSING MILKINESS IN OPTICAL GLASS. C. N. FENNER AND J. B. FERGUSON. *J. Am. Ceram. Soc.* **1,** 468–76, 1918.

The "milkiness" produced by the devitrification of certain types of crown glass is ascribed to the presence of sub-microscopic cristobalite. C. B. S.

THE HYDROTHERMAL SYNTHESIS OF MINERALS. W. J. MÜLLER AND J. KOENIGSBERGER. *Z. anorg. allgem. Chem.,* **104,** 1–26, 1918.

Leucite and orthoclase were synthesized by heating the constituents with mineralizers under pressure; the latter mineral formed only above 360°C. E. T. W.

THE PLATINUM OF MADAGASCAR. A. LACROIX. *Bull soc. franc. min.,* **41,** 98–99, 1918.

Occurrences are noted at 3 localities, with analysis of material from one of them. E. T. W.

THE NATURE OF WATER IN ZEOLITES. G. STOKLOSSA. *Neues Jahrb Min. Geol. Beil.-Bd.* **42,** 1–64, 1918; thru *Min. Abst.* **1,** 153, 1921.

Heulandite, scolecite, natrolite, harmotone, and chabazite showed during rehydration a distinct hydrate for each molecule of water present in the original mineral; the water was probably chemically combined. With analcite only the mono- and tetrahydrates were formed; in apophyllite rehydration did not occur. E. F. H.